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EXAMINER	
TON, DANG T	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/557,434	LIU ET AL.	
	Examiner	Art Unit	
	DANG T TON	2666	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 April 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-75* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-75* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

2. The disclosure is objected to because of the following informalities: Applicant should provide a serial number of the copending application recited in the specification, page 20 including the filing date and the status of the copending application.

Appropriate correction is required.

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-75 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-21,23-45, and 54-70 of U.S. Patent No. 6,122,266. Although the conflicting claims are not identical, they are not patentably distinct from each other because of the following:

For claims 1-75, the claims 1-21,23-45, and 54-70 of U.S. Patent No. 6,122,266 disclose a method/ apparatus comprising :

a multichannel transceiver array comprising a plurality of antennas and a plurality of transceivers, wherein the

multichannel transceiver array is adapted for receiving combinations of multichannel uplink S-CDMA signals from the terminals and transmitting multichannel downlink S-CDMA signals towards the terminals, wherein the multichannel transceiver array is adapted for receiving the combinations of multichannel uplink S-CDMA signals from the terminals and transmitting multichannel downlink S-CDMA signals towards the terminals during different time frames in a time division duplex manner;

a spatial processor coupled to the multichannel transceiver array for determining spatial signature estimates associated with the terminals from the combinations of multichannel uplink S-CDMA signals, wherein the spatial processor is also operable to calculate uplink and downlink beamforming matrices based on the spatial signature estimates;

a demodulator coupled to the spatial processor and the multichannel transceiver array for determining estimates of uplink messages from the terminals from the combinations of multichannel uplink S-CDMA signals;

a modulator coupled to the multichannel transceiver array for generating the multichannel downlink S-CDMA signals to transmit messages destined for the terminals (see claim 1 of the patent).

wherein each of the terminals includes a unique PN code sequence, the system further comprising:

a despreader coupled to the demodulator and the spatial processor, wherein, for each of the plurality of terminals, the despreader uses the terminal's PN code sequence to despread the combination of multichannel uplink S-CDMA signals to obtain a multichannel symbol sequence, wherein the multichannel symbol sequence comprises a plurality of symbol sequences(see claim 2 of the patent);

wherein the spatial processor produces the spatial signature estimate in response to the multichannel symbol sequence;

wherein the spatial processor identifies a symbol sequence from the multichannel symbol sequence with a maximum signal power and further operates to normalize the

multichannel symbol sequence with respect to the identified symbol sequence with the maximum signal power to obtain a normalized multichannel symbol sequence;

wherein the spatial processor operates to calculate the average of the normalized multichannel symbol sequence to produce the spatial signature estimate(see claim 3 of the patent) ;

wherein the spatial processor forms a data convariance matrix of the multichannel symbol sequence;

wherein the spatial processor calculates the principal eigenvector of the data covariance matrix as the spatial signature estimate(see claim 4 of the patent) ;

wherein the spatial processor is operable to determine individual multipath parameters including direction of arrival (DOA) estimates associated with each
of the terminals;

wherein the DOA estimates are used in locating the terminals and in assisting handoff(see claim 5 of the patent);

wherein the spatial processor determines DOA estimates based on a respective terminal's spatial signature estimate(see claim 6 of the patent);

wherein the spatial processor determines DOA estimates based on a data covariance matrix of a multichannel symbol sequence associated with a respective terminal (see claim 7 of the patent);

wherein the spatial processor determines an uplink power estimate associated with each of the terminals;

wherein the uplink power estimate is used for power control;

wherein the spatial processor determines the uplink power as the principal eigenvalue of a data covariance matrix of a multichannel symbol sequence associated with a respective terminal;

wherein the spatial processor determines an uplink power estimate associated with each of the terminals(see claim 8 of the patent);

wherein the uplink power estimate is used for power control;

wherein the spatial processor determines the uplink power as a quadratic mean of a beamformed symbol sequence associated with a respective terminal(see claim 9 of the patent) ;

wherein the spatial processor determines timing offset estimates associated with each of the terminals, wherein the timing offset estimates are used for synchronization of the terminals(see claim 10 of the patent);

wherein the spatial processor further includes:

means for determining individual multipath parameters including direction of arrival (DOA) estimates associated

with each of the terminals, wherein the DOA estimates are used in assisting handoff;

means for determining timing offset estimates associated with each of the terminals, wherein the timing offset estimates are used for synchronization;

means for determining the geolocation of a respective terminal by combining the DOA estimates and distance information provided by the timing offset estimates(see claim 11 of the patent) ;

wherein each of the terminals includes a unique PN code sequence, the system further comprising:

a despreader coupled to the demodulator and the spatial processor, wherein, for each of the terminals, the despreader operates to despread the multichannel uplink S-CDMA signals to obtain an associated spatial signature estimate, wherein, for each respective terminal of the plurality of terminals, the despreader uses the respective terminal's PN code sequence to despread
the combination of multichannel uplink S-CDMA signals to obtain a multichannel symbol sequence, wherein the

multichannel symbol sequence comprises a plurality of symbol sequences for each of the transceivers comprised in the multichannel transceiver array;

wherein the demodulator is coupled to the despreader and receives the multichannel symbol sequence output from the despreader, wherein the demodulator includes:

an uplink beamformer for obtaining enhanced signals for a respective terminal by combining the multichannel symbol sequence using the respective terminal's uplink beamforming matrix;

a detector for determining message data transmitted by the respective terminal from the enhanced signals;

wherein code and spatial diversities are both used to suppress interference and noise in signal reception(see claim 12 of the patent) ;

wherein the modulator includes:

a PN code generator for providing PN codes for each of the terminals;

a spreader coupled to the PN code generator for generating S-CDMA signals for each of the terminals, wherein the spreader uses a respective PN code for each of the terminals in generating the S-CDMA signals for each of the terminals;

a downlink beamformer for producing beamformed S-CDMA signals for each of the terminals, wherein the downlink beamformer uses the transmit beamforming matrices associated with each of the terminals in producing the beamformed S-CDMA signals for each of the terminals; and

a combiner for combining the beamformed S-CDMA signals to produce the multichannel downlink S-CDMA signals;

wherein code and spatial diversities are both used to suppress interference and noise in signal transmission(see claim 13 of the patent);

wherein, for at least a subset of the terminals, the uplink beamforming matrix for a respective terminal is identical to the spatial signature estimate for the respective terminal(see claim 14 of the patent);

wherein, for at least a subset of the terminals, the uplink beamforming matrix for a respective terminal is constructed based on the spatial signature estimates of each of the terminals to maximize a signal-to-interference-and-noise ratio (SINR) for the respective terminal(see claim 15 of the patent);

wherein, for at least a subset of the terminals, the uplink beamforming matrix for a respective terminal is constructed based on the spatial signature estimates of each of the terminals to minimize a bit-error-rate (BER) for the respective terminal(see claim 16 of the patent);

wherein, for at least a subset of the terminals, the downlink beamforming matrix for a respective terminal is identical to the spatial signature estimate for the respective terminal(see claim 17 of the patent);

wherein, for at least a subset of the terminals, the downlink beamforming matrix for a respective terminal is constructed based on the spatial signature estimates of each of the terminals to maximize a signal-to-interference-and-noise ratio (SINR) for the respective terminal(see claim 18 of the patent);

wherein, for at least a subset of the terminals, the downlink beamforming matrix for a respective terminal is constructed based on the spatial signature estimates of each of the terminals to minimize a bit-error-rate (BER) for the respective terminal(see claim 19 of the patent);

wherein each of the transceivers in the multichannel transceiver array comprises transmitter circuits and receiver circuits;

the system further comprising:

means for calibrating the multichannel transceiver array to correct for imbalance of the multichannel transceivers;

wherein the means for calibrating the receiver circuits operates before estimation of the spatial signatures;

wherein the means for calibrating the transmitter circuits operates before the transmission of the multichannel downlink S-CDMA signals(see claim 20 of the patent);

wherein the spatial processor, the demodulator and the modulator are implemented by one or more digital processors(see claim 21 of the patent);

receiving, using multichannel receivers, combinations of uplink S-CDMA signals during an uplink frame at the base station;

despreading, using terminals' PN code sequences, to obtain despread multichannel results for each of the terminals;

estimating a spatial signature associated with each of the terminals from the despread multichannel results,

thereby producing spatial signature estimates for each of the terminals,

generating receive and transmit beamforming vectors or matrices based on the terminals' spatial signature estimates;

uplink beamforming the despread multichannel results using the receive beamforming vectors or matrices to obtain enhanced signals for each of the terminals;

demodulating the enhanced signals to recover message data from each of the terminals;

modulating message data to obtain S-CDMA signals for each of the terminals;

downlink beamforming the S-CDMA signals using the transmit beamforming matrices to obtain beamformed S-CDMA signals for each of the terminals;

combining all of the beamformed S-CDMA signals to obtain downlink multichannel S-CDMA signals;

transmitting, in a downlink frame following the uplink frame, the combinations of downlink S-CDMA signals;

a multichannel transceiver array comprising a plurality of antennas and a plurality of transceivers, wherein the multichannel transceiver array is adapted for receiving combinations of multichannel uplink S-CDMA signals from the terminals and transmitting multichannel downlink S-CDMA signals towards the terminals, wherein the multichannel transceiver array is adapted for receiving the combinations of multichannel uplink S-CDMA signals from the terminals during a first time frame and is adapted for transmitting multichannel downlink S-CDMA signals towards the terminals during a second time frame in a time division duplex manner;

spatial signature estimation means coupled to the multichannel transceiver array for determining spatial signature estimates associated with the terminals from the combinations of multichannel uplink S-CDMA signals, wherein the spatial signature estimation means is also operable to

calculate uplink and downlink beamforming matrices based on the spatial signature estimates;

demodulator means coupled to the spatial signature estimation means and the multichannel transceiver array for determining estimates of uplink messages from the terminals from the combinations of multichannel uplink S-CDMA signals, and modulator means coupled to the multichannel transceiver array for generating the multichannel downlink S-CDMA signals to transmit messages destined for the terminals(see claim 23 of the patent);

wherein each of the terminals includes a unique PN code sequence, the system further comprising:

despreader means coupled to the demodulator means and the spatial signature estimation means, wherein, for each of the plurality of terminals,
the despreader means uses the terminal's PN code sequence to despread the combination of multichannel uplink S-CDMA signals to obtain a multichannel symbol sequence, wherein the multichannel symbol sequence comprises a plurality of symbol sequences;

wherein the spatial signature estimation means operates to determine the spatial signature estimate in response to the multichannel symbol sequence(see claim 24 of the patent);

wherein the spatial signature estimation means identifies a symbol sequence from the multichannel symbol sequence with a maximum signal power and further operates to normalize the multichannel symbol sequence with respect to the identified symbol sequence with the maximum signal power to obtain a normalized multichannel symbol sequence;

wherein the spatial signature estimation means operates to calculate the average of the normalized multichannel symbol sequence to produce the spatial signature estimate(see claim 25 of the patent);

wherein the spatial signature estimation means forms a data convariance matrix of the multichannel symbol sequence;

wherein the spatial signature estimation means calculates the principal eigenvector of the data covariance matrix as the spatial signature estimate(see claim 26 of the patent);

wherein the spatial signature estimation means further includes:

means for determining individual multipath parameters including direction of arrival (DOA) estimates associated with each of the terminals;

wherein the DOA estimates are used in locating the terminals and in assisting handoff(see claim 27 of the patent);

wherein the spatial signature estimation means further includes,

means for determining an uplink power estimate associated with each of the terminals;

wherein the uplink power estimate is used for power control(see claim 28 of the patent);

a spatial signature estimator means for estimating a plurality of spatial signatures associated with a plurality of uplink signals received from a corresponding plurality of remote terminals wirelessly coupled to the base station, the plurality of uplink signals simultaneously received on a common carrier frequency during an uplink time slot;

a downlink beamformer means coupled to the spatial signature estimator means and responsive to the plurality of spatial signatures for beamforming a plurality of downlink beamforms correspondingly unique to each of the plurality of remote terminals and for simultaneously transmitting a plurality of downlink signals to the plurality of remote terminals on the common carrier frequency during a downlink time slot subsequent to the uplink time slot;

a code division multiple access modulator means coupled to the downlink beamformer means for code modulating each

of the plurality of downlink signals on a corresponding plurality code channels whereby each of the plurality of downlink signals has a unique downlink beamform and a unique code channel on the common carrier frequency;

a parameter estimator means coupled to the spatial signature estimator means for further processing at least one of the plurality of spatial signatures for determining a corresponding direction of arrival vector associated with a remote terminal of the plurality of remote terminals, wherein the downlink beamformer means is not dependent upon the direction of arrival vector for beamforming a downlink beamform associated with the remote terminal(see claim 29 of the patent);

wherein the spatial signature estimator means determines a timing offset unique to each of the plurality of remote terminals for communication thereto, thereby enabling synchronization of each of the plurality received uplink signals(see claim 30 of the patent);

wherein at least one of the plurality of downlink beamforms is substantially identical to a corresponding at

least one of the plurality of spatial signatures(see claim 31 of the patent);

wherein at least one of the plurality of downlink beamforms is optimized for maximum signal-to-interference-and noise performance by accounting for noise characteristics as well as other spatial parameters(see claim 32 of the patent);

wherein at least one of the plurality of downlink beamforms is optimized for maximum bit-error-rate performance by accounting for noise characteristics as well as other spatial parameters(see claim 33 of the patent);

a demodulator means for demodulating each of the plurality of uplink signals received by an array of antenna elements to produce a multiplicity of demodulated uplink signals having the plurality of uplink signals received by each element of the array of antenna elements; wherein

the spatial signature estimator means is coupled to the demodulator means and estimates the plurality of spatial signatures in response to the multiplicity of demodulated uplink signals, the smart antenna base station

further comprising;

a modulator means coupled to the array of antenna elements and the downlink beamformer means for producing a multiplicity of modulated downlink signals having components associated with each element of the array of antenna elements by uniquely modulating each of the plurality of downlink signals for each element of the array of antenna elements to beamform the plurality of downlink beamforms(see claim 34 of the patent);

wherein each of the spatial signatures is either a vector or a matrix, further wherein the matrix is used in applications where a propagation channel is frequency selective with long delay multipath(see claim 35 of the patent);

wherein the number of the plurality of downlink beamforms exceeds the number of elements of the array of antenna elements thereby making the base station an adaptive antenna system rather than a sectored antenna system(see claim 36 of the patent);

wherein the demodulator means is further responsive to the spatial signature estimator means for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector substantially identical to a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal(see claim 37 of the patent);

wherein the demodulator means is further responsive to the spatial signature estimator means for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector constructed from a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal,

the construction taking into account noise and interference characteristics as

well as other spatial parameters to maximize signal-to-interference-and noise performance(see claim 38 of the patent);

wherein the demodulator means is further responsive to the spatial signature estimator means for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector constructed from a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal,
the construction taking into account noise and interference characteristics as well as other spatial parameters to maximize bit-error-rate performance(see claim 39 of the patent);

an antenna means having the array of antenna elements for wirelessly receiving the plurality of uplink signals modulated upon the common carrier frequency;

a receiver means having an array of receivers, each receiver correspondingly coupled to one element of the array of antenna elements, the receiver means for separating the plurality of uplink signals from the common carrier frequency; wherein

the demodulator means is coupled to the receiver means and is for demodulating each of the plurality of uplink signals from each receiver of the array of receivers to produce the multiplicity of demodulated uplink signals, and further comprising;

a transmitter means having an array of transmitters, each transmitter correspondingly coupled to one element of the array of antenna elements, the transmitter means for wirelessly transmitting the plurality of downlink signals on the common carrier frequency; wherein

the modulator means is coupled to the array of antenna elements through the transmitter means(see claim 40 of the patent);

a combiner means for digitally combining components of the multiplicity of modulated downlink signals associated with each element of the array of antenna elements to produce an array of combined signals, wherein the multiplicity of modulated downlink signals are of a digital nature;

a pulse shaper means coupled to the combiner means for digitally shaping each signal of the array of combined signals to produce a corresponding array of digitally shaped signals;

a digital to analog converter means coupled to the pulse shaper means and the transmitter means for converting the array of digitally shaped signals to
a corresponding array of analog shaped signals; wherein

the transmitter means modulates the array of analog shaped signals upon the common carrier frequency(see claim 41 of the patent);

wherein, the modulator means, the downlink beamformer means and the combiner means are comprised within a fast hadamard transform means(see claim 42 of the patent);

a pulse shaper means coupled to the modulator means for digitally shaping the each component of the multiplicity of modulated downlink signals to produce a corresponding multiplicity of digital shaped signals;

a digital to analog converter means coupled to the pulse shaper means for converting the multiplicity of digitally shaped signals to a corresponding multiplicity of analog shaped signals;

an analog combiner means coupled to the digital to analog converter means for combining the components of the multiplicity of analog shaped signals associated with each element of the array of antenna elements to produce an array of combined signals; wherein

the transmitter means modulates the array of combined signals upon the common carrier frequency(see claim 43 of the patent);

wherein each of the plurality of uplink signals include a unique PN sequence from each of the plurality of remote terminals and further comprises:

a despreader means for despreading each PN sequence to obtain a multichannel symbol sequence comprising a plurality of symbol sequences wherein the spatial signature estimator means;

identifies a first symbol sequence from the multichannel symbol sequence having a maximum power;

normalizes the multichannel symbol sequence with respect to the first symbol sequence to produce a normalized multichannel symbol sequence;

calculates an average of the normalized multichannel symbol sequence to estimate a corresponding one of the plurality of spatial signatures(see claim 44 of the patent);

wherein each of the plurality of uplink signals include a unique PN sequence from each of the plurality of remote terminals and further comprises:

a despreader means for despreading each PN sequence to obtain a multichannel symbol sequence comprising a plurality of symbol sequences wherein the spatial signature estimator means;

forms a data covariance matrix of the multichannel symbol sequence;

calculates a principal eigen vector of the data covariance matrix to estimate a corresponding one of the plurality of spatial signatures(see claim 45 of the patent);

a spatial signature estimator for estimating a plurality of spatial signatures associated with a plurality of uplink signals received from a corresponding plurality of remote terminals wirelessly coupled to the base station, the plurality of uplink signals simultaneously received on a common carrier frequency during an uplink time slot;

a downlink beamformer coupled to the spatial signature estimator and responsive to the plurality of spatial signatures for beamforming a plurality of downlink

beamforms correspondingly unique to each of the plurality of remote terminals and for simultaneously transmitting a plurality of downlink signals to the plurality of remote terminals on the common carrier frequency during a downlink time slot subsequent to the uplink time slot; and

a code division multiple access modulator coupled to the downlink beamformer for code modulating each of the plurality of downlink signals on a corresponding plurality code channels whereby each of the plurality of downlink signals has a unique downlink beamform and a unique code channel on the common carrier frequency;

a demodulator for demodulating each of the plurality of uplink signals received by an array of antenna elements to produce a multiplicity of demodulated uplink signals having the plurality of uplink signals received by
each element of the array of antenna elements;

wherein the spatial signature estimator is coupled to the demodulator and estimates the plurality of spatial signatures in response to the multiplicity of demodulated uplink signals(see claim 54 of the patent);

wherein the spatial signature estimator determines a timing offset unique to each of the plurality of remote terminals for communication thereto, thereby enabling synchronization of each of the plurality received uplink signals(see claim 55 of the patent);

further comprising a parameter estimator coupled to the spatial signature estimator for further processing at least one of the plurality of spatial signatures for determining a corresponding direction of arrival vector associated with a remote terminal of the plurality of remote terminals, wherein the downlink beamformer is not dependent upon the direction of arrival vector for beamforming a downlink beamform associated with the remote terminal(see claim 56 of the patent);

wherein at least one of the plurality of downlink beamforms is substantially identical to a corresponding at least one of the plurality of spatial signatures(see claim 57 of the patent);

wherein at least one of the plurality of downlink beamforms is optimized for maximum signal-to-interference-and noise performance by accounting for noise characteristics as well as other spatial parameters(see claim 58 of the patent);

wherein at least one of the plurality of downlink beamforms is optimized for maximum bit-error-rate performance by accounting for noise characteristics as well as other spatial parameters(see claim 59 of the patent);

wherein each of the spatial signatures is either a vector or a matrix, further wherein the matrix is used in applications where a propagation channel is frequency selective with long delay multipath(see claim 60 of the patent);

wherein the number of the plurality of downlink beamforms exceeds the number of elements of the array of antenna elements thereby making the base station an adaptive antenna system rather than a sectored antenna system(see claim 61 of the patent);

wherein the demodulator is further responsive to the spatial signature estimator for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector substantially identical to a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal(see claim 62 of the patent);

wherein the demodulator is further responsive to the spatial signature estimator for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector constructed from a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal, the construction taking into account noise and interference characteristics as well as other spatial parameters to maximize signal-to-interference-and noise performance(see claim 63 of the patent);

wherein the demodulator is further responsive to the spatial signature estimator for constructively combining at least one uplink signal of the plurality of uplink signals received upon each element of the array of antenna elements to produce a constructively combined demodulated uplink signal in response to an uplink beamforming vector constructed from a spatial signature of the plurality of spatial signatures associated with the at least one uplink signal, the construction taking into account noise and interference characteristics as well as other spatial parameters to maximize bit-error-rate performance(see claim 64 of the patent);

further comprising:

an antenna having the array of antenna elements for wirelessly receiving the plurality of uplink signals modulated upon the common carrier frequency;

a receiver having an array of receivers, each receiver correspondingly coupled to one element of the array of antenna elements, the receiver for separating the plurality of uplink signals from the common carrier frequency;

wherein the demodulator is coupled to the receiver and is for demodulating each of the plurality of uplink signals from each receiver of the array of receivers to produce the multiplicity of demodulated uplink signals, and further comprising;

a transmitter having an array of transmitters, each transmitter correspondingly coupled to one element of the array of antenna elements, the transmitter for wirelessly transmitting the plurality of downlink signals on the common carrier frequency, wherein the modulator is coupled to the array of antenna elements through the transmitter(see claim 65 of the patent);

further comprising:

a combiner for digitally combining components of the multiplicity of modulated downlink signals associated with each element of the array of antenna elements to produce an array of combined signals, wherein the multiplicity of modulated downlink signals are of a digital nature;

a pulse shaper coupled to the combiner for digitally shaping each signal of the array of combined signals to produce a corresponding array of digitally shaped signals; and

a digital to analog converter coupled to the pulse shaper and the transmitter for converting the array of digitally shaped signals to a corresponding array of analog shaped signals; wherein the transmitter modulates the array of analog shaped signals upon the common carrier frequency(see claim 66 of the patent);

wherein, the modulator, the downlink beamformer and the combiner are comprised within a fast hadamard transform unit(see claim 67 of the patent);

further comprising:

a pulse shaper coupled to the modulator for digitally shaping the each component of the multiplicity of modulated downlink signals to produce a corresponding multiplicity of digital shaped signals;

a digital to analog converter coupled to the pulse shaper for converting the multiplicity of digitally shaped signals to a corresponding multiplicity of analog shaped signals;

an analog combiner coupled to the digital to analog converter for combining the components of the multiplicity of analog shaped signals associated with each element of the array of antenna elements to produce an array of combined signals; wherein

the transmitter modulates the array of combined signals upon the common carrier frequency(see claim 68 of the patent);

wherein each of the plurality of uplink signals include a unique PN sequence from each of the plurality of remote terminals, wherein the smart antenna base station further comprises:

a despreader for despreading each PN sequence to obtain a multichannel symbol sequence comprising a plurality of symbol sequences wherein the spatial signature estimator:

identifies a first symbol sequence from the multichannel symbol sequence having a maximum power;

normalizes the multichannel symbol sequence with respect to the first symbol sequence to produce a normalized multichannel symbol sequence;

calculates an average of the normalized multichannel symbol sequence to estimate a corresponding one of the plurality of spatial signatures(see claim 69 of the patent);

wherein each of the plurality of uplink signals include a unique PN sequence from each of the plurality of remote terminals, wherein the smart antenna base station further comprises:

a despreader for despreading each PN sequence to obtain a multichannel symbol sequence comprising a plurality of symbol sequences wherein the spatial signature estimator:

forms a data covariance matrix of the multichannel symbol sequence;

calculates a principal eigen vector of the data covariance matrix to estimate a corresponding one of the plurality of spatial signatures(see claim 70 of the patent) .

For claims 22-40, the claims 23-27 and 8-10 of patent disclose all the subject matter of the claimed invention with the exception disclosing method claims (the claims 23-27 and 8-10 of the patent disclose apparatus claims). However using the apparatus claims of the patent to modify/implement the method claims is well-known in the art since they perform the same function. Thus, it would have been obvious to the person of ordinary skill in the art at the time of the invention to use the apparatus claims as taught by the patent application to implement the method claims. The motivation for modifying the apparatus claims 23-27 and 8-10 of the patent into the method claims being that it provides the method performing the same function as the apparatus claims.

For claims 41-57, and 58-75, Applicant's claims, merely broaden the scope of patent number 6,122,260 claims 29-45, and 54-70, respectively, by eliminating the terms "means"

from claim 41 and " a demodulator ..... up link signal " from claim 54 of the patent. It has been held that the omission of an element and its function is an obvious expedient if the remaining elements perform the same function as before. In re karlson, 136 USPQ 184 (CCPA). Also note Ex Parte Raine, 168 USPQ 375 (bd. App. 1969); omission of a reference element whose function is not need would be obvious to one skilled in the art.

For claims 1-21, The patent claims 1-21 disclose all the subject matter of the claimed invention with the exception of the demodulator/modulator using the uplink/down link beamforming matrices in determining the estimates the messages from the terminals. However, the claim 1 of the patent does teach the uplink/down link beaming matrices based on the spatial signature estimates (see claim 1 lines 15-16). Thus, it would have been obvious to the person of ordinary skill in the art at the time of the invention to use the uplink/down link beaming matrices based on the spatial signature estimates to determining the estimates the messages from the terminals. The demodulator/modulator using the uplink/down link beamforming matrices in determining the estimates the messages from the terminals can be implemented/modified into the claim 1 of the patent

by using the spatial signature for the purpose of estimating the message motivation and providing adaptation of the multichannel transceiver array.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANG T TON whose telephone number is 703-305-4739. The examiner can normally be reached on MON-WED, 5:30 AM-6:00 PM and Thur 5:30-9:30 A.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, RAO SEEMA can be reached on 703-308-5463. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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D. Ton

DANG TON
PRIMARY EXAMINER